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GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA

Monthly Progress Report

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EREP Investigation 380

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Dr. Keenan Lee
Geology Department
Colorado School of Mines
Golden, Colorado 80401

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Submitted to:

Mr. Martin Miller, Technical Monitor
Principal Investigations Management Office
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INTRODUCTION

The primary objective of the CSM Skylab Program is to analyze EREP data for geologic information. To this end, the research has been subdivided into the following tasks;

Task I. The PI shall assist NASA/MSC in mission planning activities related to the proposed investigation.

Task II. The investigator will screen all EREP data obtained over Colorado and will select frames for detailed study.

Task III. The investigator will prepare photogeologic maps using selected S-190 photographs, and will analyze them to determine what geologic information may be contained in them.

Task IV. The geological interpretations obtained in Task 3 will be compared to interpretations obtained from S-192 imagery, and to interpretations made from ERTS-I imagery.

Task V. The geological interpretations will be verified by means of interpretation of aerial photographs, published geological reports, and field observations.

Task VI. The investigator will prepare recommendations for the optimum type, scale, and resolution of imagery to be used for studies of regional geology and exploration for mineral deposits and water resources.

PROGRESS

Overall Status

With this report, Milestones 1 through 9 have been achieved, with the exception of Milestone 6 (Evaluation of SL-2 data-partially completed). The project is behind schedule because of late delivery of data.

Past Month's Activities

Work continued on the compilation of the Bonanza Test Site geologic map (90% complete) and the geologic map and report on the Regional Geology Test Site (now 100% complete, lacking only reproduction).

Interpretation and compilation of high-altitude color and CIR photography for the southern Front Range was completed. That for eastern South Park is near completion. Many new structural features and relationships have been observed that will be looked for on EREP data on hand. Cloud cover on the latter obscures most of the southern Front Range, but the western Front Range and South Park are cloud-free.

A little time was spent developing a theory of selective shadow enhancement of linears and suggesting experiments to demonstrate it.

During the month of November the evaluation of available Skylab photography along tracks 34 and 48 was continued, and was expanded to cover track 34, S190B 2X enlargements, and track 34 and 48, S190A 4X enlargements (9" x 9" format). Preliminary work suggests that the enhargements 1) make it much easier to map features that can also be seen on the 70mm format, and 2) may reveal details not seen on 70mm format.

An introductory project, evaluating the Colorado Mineral Belt by remote sensors, is in progress. An outline of this project follows:

I. Familiarization with Skylab EREP data
   A. Analyze S190A, T.48, frames 16,17,18 (mineral belt area), 70mm pos. trans. and 9" x 9" pos. trans. format, for:

1. Structures (e.g.- photolinears, circular features, atitude of units)
2. Lithologic variations, contacts, alteration (where possible)
3. Ease of viewing of each band, best band for viewing
4. Best size for viewing

II. Obtain published geologic information of study area; compare what can be seen by a photo-interpreter to published geologic maps.

A. On the basis of photo-interpretation, pick exploration target areas. State criteria.

III. Familiarization with the geology of two well-known mineralized areas, the Leadville and Cripple Creek districts. Study of structures, lithologies, and alteration. Determine if these features can be recognized on EREP photos.

IV. Scan frame 17, T.48, S190A for other areas with similar features.

A. Mark these areas as new targets; compare with earlier target choices.

B. Pick target (state criteria) and ground check for desired criteria.

Preliminary observations:

Excellent synoptic view from 70mm format, 3X stereo viewing. Fair amount of mappable detail with 70mm format at 14X magnification, but impossible to transcribe everything seen. On roll 17 (red band, best contrast) it is difficult, at best, to discriminate lithologies and/or contacts. Shades (tones) are gradational in most cases, and it is difficult to gauge the influence of vegetation in smoothing tonal contrasts at lithologic contacts.

The 9" x 9" pos. trans. format cannot be viewed at greater than 4X magnification. 3X magnification yields plenty of detail and a sufficiently wide field of view so that regional features are still seen.

Preliminary work with the 9" x 9" format reveals the ability to recognize linears (real or imagined), some dipping beds, circular

features (may be glacial, volcanic, or structure-controlled drainages), contacts between bedrock and valley-fill, between bedded and non-bedded units, between sediments (?) and volcanics, and between moist and dry soils (especially on color-infrared and photo-infrared bands). The linears, dipping beds, and circular features are all expressed through topography. Contacts are expressed chiefly by tone contrasts. Some linears, such as mountain fronts, appear to be enhanced by snow cover at higher altitudes, whereas the snow seems to wipe out most detail at high-altitudes.

Two summary papers have been submitted to the University of Michigan for consideration for presentation at the 9th International Symposium on Remote Sensing of Environment. Copies of these summaries were sent to PIMO.

Planned Activities for Current Month

Plans for December are to continue the Bonanza geologic map compilation, the preliminary examination of new Skylab photographs, and to select suitable test sites for geologic evaluation of Skylab photographs.

We are still awaiting the LSAP underflight of Skylab 4.

Test enlargements of one S190A frame will be made from 4X negatives provided by NASA. Enlarged prints at 4X, 8X and 12X will be analyzed for quality and use.

Travel

Travel during November consisted of one trip by the PI to NASA/JSC for data screening.

No travel is anticipated during December.

Outlook and Recommendations

With the recent receipt (27 November) of SL2 enlargements, progress should accelerate, although research will still continue behind schedule.

Keenan Lee
Principal Investigator